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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No. 2425-1-1

First Inventor or Application Identifier LAPALME

Title VIDEO-ASSISTED APPARATUS FOR HEARING IMPAIRED

Express Mail Label No.

PERSONS

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

- ☒ * Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)
- ☒ Specification [Total Pages 28]
(preferred arrangement set forth below)
 - Descriptive title of the invention
 - Cross References to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to Microfiche Appendix
 - Background of the invention
 - Brief Summary of the invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure
- ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 2]
- Oath or Declaration [Total Pages 6]
 - ☒ Newly executed (original or copy)
 - ☐ Copy from a prior application (37 C.F.R. § 1.63(d))
(for continuation/divisional with Box 16 completed)
 - ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

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ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

- ☐ Microfiche Computer Program (Appendix)
- Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
 - ☐ Computer Readable Copy
 - ☐ Paper Copy (identical to computer copy)
 - ☐ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

- ☐ Assignment Papers (cover sheet & document(s))
- ☐ 37 C.F.R. § 3.73(b) Statement of Power of Attorney (when there is an assignee)
- ☐ English Translation Document (if applicable)
- ☒ Information Disclosure Statement (IDS)/PTO-1449 ☒ Copies of IDS Citations
- ☐ Preliminary Amendment
- ☒ Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
- ☒ * Small Entity Statement(s) ☐ Statement filed in prior application, Status still proper and desired (PTO/SB/09-12)
- ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed)
- ☐ Other.

16. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment:

☐ Continuation ☐ Divisional ☒ Continuation-in-part (CIP) of prior application No: 08, 867, 024

Prior application information: Examiner Richard LEE

Group / Art Unit: 2713

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

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Signature

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16 August 2000

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**STATEMENT CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) & 1.27(b))—INDEPENDENT INVENTOR**

Docket Number (Optional)

2425-1-1

Applicant, Patentee, or Identifier: LAPALME, Marie

Application or Patent No.: _____

Filed or Issued: _____

Title: VIDEO-ASSISTED APPARATUS FOR HEARING IMPAIRED PERSONS

As a below named inventor, I hereby state that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees to the Patent and Trademark Office described in:

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AUDISOFT TECHNOLOGIE INC.

Separate statements are required from each named person, concern, or organization having rights to the invention stating their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

Marie LAPALME

NAME OF INVENTOR

NAME OF INVENTOR

NAME OF INVENTOR

Marie Lapalme
Signature of inventor

Signature of inventor

Signature of inventor

6 Oct 2000
Date

Date

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STATEMENT CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) & 1.27(c))--SMALL BUSINESS CONCERN

Docket Number (Optional)
2425-1-1

Applicant, Patentee, or Identifier: LAPALME, Marie
Application or Patent No.: _____
Filed or Issued: _____
Title: VIDEO-ASSISTED APPARATUS FOR HEARING IMPAIRED PERSONS

I hereby state that I am

- ☒ the owner of the small business concern identified below.
☐ an official of the small business concern empowered to act on behalf of the concern identified below.

NAME OF SMALL BUSINESS CONCERN AUDISOFT TECHNOLOGIE INC.

ADDRESS OF SMALL BUSINESS CONCERN 1470B, Juliot Curie
Parc Industriel de Boucherville, Boucherville (Quebec)
CANADA J4B 3X3

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NAME OF PERSON SIGNING Marie LAPALME

TITLE OF PERSON IF OTHER THAN OWNER _____

ADDRESS OF PERSON SIGNING 1470B, Juliot Curie Boucherville (Quebec)

J4B 3X3 CANADA
SIGNATURE Marie Lapalme DATE 6/12/2000

TITLE OF THE INVENTION: VIDEO-ASSISTED APPARATUS FOR HEARING
IMPAIRED PERSONS

CROSS-REFERENCE DATA

5 This is a Continuation-in-Part of co-pending U.S. patent application No.
08/867,024 filed on June 2, 1997, by the present applicant.

FIELD OF THE INVENTION

10 The present invention relates to aid apparatuses for hearing impaired persons,
and more particularly to a video-assisted apparatus for hearing impaired persons.

BACKGROUND OF THE INVENTION

15 It is common for hearing impaired persons to use portable amplifier devices that
can be hooked on and supported by the ear, and more particularly behind the auricle, with a
semi-flexible pipe extending into the acoustic meatus. These devices amplify the sounds so as
to allow the hearing impaired person to more clearly hear surrounding sounds. However, when
the hearing disability is acute, or when the person is completely deaf, these amplifier devices
may not be sufficient or may be entirely useless.

20 People with this acute hearing disability or complete deafness communicate via
a sign language and via reading the movement of the lips of the person transmitting
information. Even when the hearing disability is not extremely important, reading the lips of

the interlocutor is common practice, and can be used concurrently with the hearing aid device, to help understand the sometimes less understandable pronunciation of a speaker person. When the speaker does not have free access to use its hands during conversation, especially teachers having to manipulate board chalks, notes for their courses or other devices, the reading of the lips takes a particular importance, since sign language cannot be relied upon.

However, for the lip reading to be readily accomplished, the teacher must always face its class students. Moreover, the number of students is then limited, because of the maximum distance from the teacher which can be tolerated, for lip reading by a student located far away from the teacher will be significantly hampered, if not completely impossible. Also, a teacher facing a particular portion of the class students would do so to the detriment of others. Finally, the teacher may not readily use the blackboard usually located at the front end of the class, behind the teacher, while simultaneously talking, for the teacher would then be turning his back to the class students, who could not see his lips and therefore could not accomplish the lip reading.

In an era where most types of professions are accessible to the hearing impaired or deaf persons, it is possible also that the teacher be called upon to manipulate machinery, work on wood components, or work in many other fields requiring hand held equipment, in which sign language is difficult, if not impossible, during the equipment operation, and in which lip reading can be difficult, depending on the equipment used.

United States patent No. 5,886,735 issued in 1999 to E.T. Bullister shows a headset including a head-engaging frame supporting a camera which, directly or through a

reflecting mirror, will film the facial area of the person wearing the headset. The headset can be provided with a microphone. The person wearing the headset is thus able to transmit both his image and his speech through computerised means, for allowing videoconferencing. The subject matter disclosed in the Bullister patent is especially oriented towards the question of the correction of the distortion of the image obtained by the camera, since the camera is positioned in a closely adjacent fashion relative to the face of the person wearing the headset.

One problem with the system disclosed in the Bullister patent is that the image transmission does not occur in real time. According to the person skilled in the art of the present invention, real time is defined as a maximum delay of 33 msec (milliseconds) between the moment when the image is perceived and the moment when the sound is perceived (c.f. "The Effect of Imperfect Cues on the Reception of Cued Speech", written by Maroula Sarah Bratakos of the Massachusetts Institute of Technology, September 1995). In the Bullister patent, software image correction occurs, which is time-consuming, i.e. at least about 500 msec for a full image. Furthermore, signal compression through a MPEG compressor takes place, which delays the image transfer of approximately 33msec, as does the decompression through a MPEG decompressor, the latter not being shown in the Bullister patent, but being necessary to decompress the image compressed by the MPEG compressor. Thus, important delays amounting to up to 2000% and more of a real time transmission, occur with the device shown in the Bullister patent.

This relatively important time delay in the transmission of the images during video-conferencing, is not a problem with the system of the Bullister patent, since there is no

need for precise real time transmission of the image in video-conferencing technology. Indeed, since the sound transferred through the computerised means can be synchronised with the image, the videoconferencing participants will not notice any time delay between the sound and the image being transferred. A 100 to 600 msec delay can occur without hampering significantly the video-conference. However, this important time delay can and does become an important problem in the field of the present invention.

Another problem associated with the system of the Bullister patent, is that it uses phone lines to transmit its information, using a modem. Again, this is not a problem in the field of video-conferencing, but is a problem in the field of the present invention. Indeed, the cumbersome computer, with wires and casings, is not adapted for high mobility purposes in which freedom of movement is required.

Yet another problem associated with the device shown in the Bullister patent, is that it includes an image correction device. The Bullister patent shows this device as either a distortion correction software, which is time consuming as detailed hereinabove; or a mirror or a lense which will both diminish the quantity of light received by the camera, and thus the image will be obscured.

International patent application filed under number PCT/JP85/00398 and published under number WO 86/01060 on February 13, 1986 – inventor Hiroshi ONO – discloses a data transmitting device using a telephone. Figure 6 of the Ono patent application shows an embodiment of this invention in which a teacher uses the system according to the Ono application, for the benefit of hearing-impaired students in a class. Indeed, the teacher is

equipped with a headset carrying a camera filming the teacher's lips, and transmitting this information to a screen provided on the hearing impaired student's desk to allow the student to accomplish lip-reading on the screen when he cannot directly view the teacher's lips.

An important problem with the system according to the Ono application, is that a telephone data transmission occurs. Indeed, the heart of the Ono application relies on the data phone-type transmission, including wires linking the camera headset to the end visualising screens. This is very undesirable, for three reasons:

- 1) the telephone system shown in the Ono application is heavy and cumbersome;
- 2) the wires linking all the elements are also very cumbersome, especially since they limit the movements of the teacher, who may become entangled in his wires; and
- 3) use of the phone lines restricts the quantity of information that can be sent to the screens; for example, conventional phone lines are limited to frequencies which are not higher than 3500 Hz, with the consequence that high-frequency syllables or letters, for example the letters "s", "f" and "th", become very difficult to hear and differentiate from one another. This is to be compared to the 20 Hz minimum to 20 000 Hz maximum range of frequency of sounds for which the normal person can be sensitive with his ears.

OBJECTS OF THE INVENTION

It is the gist of the invention to provide an apparatus for allowing hearing impaired persons or deaf persons to understand a speaker by reading his lips, while allowing this speaker to have freedom of movement, especially of his head and hands.

It is an important object of this invention that this apparatus be light and uncumbersome for the person using it.

It is yet another object of this invention that many hearing impaired or deaf persons may simultaneously profit from this apparatus used by the speaker, notwithstanding their position relative to the speaker.

It is another object of the invention to provide a device of the character described, which is to be used across short distances for allowing a low-power transmission to occur.

It is an object of the present invention that the speech and images be transmitted across two different transmission channels.

SUMMARY OF THE INVENTION

The present invention relates to a real-time video-assisted apparatus for use by a speaker and hearing impaired persons, for reproducing in real-time an image of the speaker's mouth, comprising:

- a headset frame to be removably installed on the head of the speaker;
- a real-time image transmission and display circuit including:
 - a) a miniature camera rigidly carried by said headset frame ahead of the speaker's mouth and destined to target at least the speaker's mouth for catching continuous video images therefrom;
 - b) a low-power video transmitter operatively linked to said camera, for coding

the video images caught by said camera and for real-time transmission thereof as a low-power wireless video signal, said video transmitter including a power device for powering said camera and said video transmitter;

c) at least one video receiver, located substantially closely to said video transmitter, for receiving said low-power wireless video signal in real-time from said video transmitter and decoding it into video images; and

d) at least one visualising device operatively linked to said at least one video receiver, for visualising the images decoded by said video receiver in real-time relative to the sound emitted by the speaker;

wherein said apparatus includes a real-time transmission of the images of the speaker's mouth to said at least one visualising device, whereby at least the lip movements and preferably all facial expressions of the speaker are followed in real-time simultaneously by any number of hearing impaired persons looking at the visualising device notwithstanding the head orientation or position of the speaker relative to the hearing impaired persons.

Preferably, said video transmitter emits said video signal at a maximum field strength of 50 millivolts per meter measured at a distance of three meters from said video transmitter.

Preferably, said video assisted apparatus further comprises:

- a microphone carried by said headset frame and linked to an audio transmitter, for catching the sound waves emitted by the speaker's voice in a continuous fashion;
- a low-power audio transmitter operatively linked to said microphone, for coding the

sounds caught by said microphone and for real-time transmission thereof as a low-power wireless audio signal, said audio transmitter including a power device for powering said microphone and said audio transmitter;

- at least one audio receiver, located substantially closely to said audio transmitter, for receiving said low-power wireless audio signal in real time from said audio transmitter and decoding it into sounds; and

- at least one amplifying device operatively linked to said at least one audio receiver, for emitting the sounds decoded by said audio receiver in real-time relative to the sound emitted directly by the speaker;

wherein said apparatus includes a real-time transmission of the sounds of the speaker's mouth to said at least one amplifying device, whereby the speech of the speaker can be simultaneously heard directly from the speaker and through said video-assisted apparatus.

Preferably, said audio transmitter emits said audio signal at a maximum field strength of 80 millivolts per meter measured at a distance of 3 meters from said audio transmitter.

Preferably, said video transmitter and said audio transmitter are distinct, and wherein said audio receiver and said video receiver are also distinct, whereby said wireless video signal and said wireless audio signal are transmitted as two distinct signals on respective wave bands.

Preferably, said video signal is transmitted in the frequency range of 902-928 MHz, while said audio signal is transmitted in the frequency range of 72-76 MHz.

Preferably, said video transmitter and said audio transmitter are a single transmitter element, whereby said audio signal and said video signal are transmitted as a single, combined signal.

Preferably, said amplifying device is a hearing aid device.

Preferably, said microphone, said audio transmitter and said audio receiver are sensitive to a frequency range substantially within the average human sound sensitivity of 20Hz to 20 000 Hz.

DESCRIPTION OF THE DRAWINGS

In the annexed drawings:

Figure 1 is a perspective view showing a school teacher wearing a headset including to the video-assisted apparatus of the invention, with two students located behind her at their respective desks, on which are installed video monitor screens of the video-assisted apparatus; and

Figure 2 is an enlarged perspective view of the headset portion of the video-assisted apparatus, with the headset being partly fragmented and with the camera support arm being partly broken, and suggesting with several arrows the possible headset adjustments for orienting and positioning the camera relative to the teacher's mouth and to compensate for various head sizes.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figure 1 shows a preferred embodiment of a video-assisted apparatus 10 for use by a speaker S and a number of hearing impaired persons H. Apparatus 10 comprises a headset frame 12 equipped with a small camera 14, a transmitter 16, a number of remotely located receivers 18 and an equal number of visualising means in the form of television or computer screens or LCD or LED screens 20. Apparatus 10 also comprises a microphone 47.

As shown in figure 2, headset frame 12 resembles conventional receptionist-style phone headset frames and comprises a flat arcuate rigid headpiece 22 defining a first and a second end 22a and 22b, headpiece 22 forming substantially a 180° (half-turn) arc. Rigid headpiece 22 comprises a slight flexibility, to allow its two ends 22a, 22b to be manually forcibly parted, to be inserted onto a person's head and thereafter snugly engage same, as will be explained hereinafter.

On headpiece first end 22a is fixed a triangular, rigid first abutment member 24, on the interior face of which a temple padding cushion 26 is provided for the comfort of the user's head.

Headpiece 22 frictionally engages and extends through a cylindrical socket member 28 and its second end 22b is provided with a circumferential stopper 30 that prevents socket 28 from accidentally releasing headpiece 22. By forcibly sliding headpiece 22 through socket member 28 against the friction force therein, an adjustment of the dimension of headset 12 is acquired to fit heads of different sizes, as known in the art. Socket member 28 is fixedly attached to a rigid, inverted U-shaped second abutment member 32 having a pair of downwardly extending legs 32a, with only one of these legs being shown in figure 2 for clarity

of the drawing. Each leg 32a is provided with an interior padding cushion 33, for the comfort of the user's head.

The outer flat surface of cylindrical socket 28 is equipped with a small axially projecting stud 34 which frictionally snaps into a complementary hole 36 made through the inner flat surface of a hollow cylindrical dial 38 which rests against and axially and diametrically registers with socket 28. Dial 38 has a pair of diametrically aligned notches 38a, 38b axially extending in its cylindrical peripheral surface, opposite socket 28, through which a hollow, elongated cylindrical camera supporting arm 40 is installed. An inner grooved compression cap 42 engages and holds arm 40 at the position in which it is installed, due to a threaded outer cap 44 which threadingly engages dial 38 so as to apply axial pressure on compression cap 42 which frictionally traps arm 40 in notches 38a, 38b to prevent linear displacement thereof. Therefore, the position of arm 40 can be selectively adjusted along dial 38 by removing caps 42, 44 and sliding arm 40 inside notches 38a, 38b, as suggested by arrow A1 in figure 2; the position of arm 40 can then be frictionally fixed relative to dial 38 by installing caps 42, 44 and threadingly tightening outer cap 44 on dial 38. Moreover, the angular position of arm 40 can be selectively adjusted by forcibly turning dial 38 against the friction force of stud 34 against hole 36, as suggested by arrow A2 in figure 2, and then releasing arm 40 at the desired angular position.

Supporting arm 40 defines a first and a second opposite ends 40a, 40b, with first end 40a being located proximate dial 38 and second end 40b supporting camera 14. Figure 1 further shows that arm 40 is elbowed at two intermediate locations, 40c and 40d, for

ergonomically conforming to the general shape of the face of the speaker S, as is known in the state of the art headsets.

Camera 14 is of the conventional miniature type. Preferably, it is approximately cubic with a side dimension of approximately 1,25 centimeters. This miniature camera is small, uncumbersome and of light weight, and therefore will not hamper or distract the speaker S when she is talking. As seen in figure 2, camera 14 is installed on a joint 46 and has a lens 48 destined to target the mouth of the speaker, as will be explained hereinafter. Joint 46 is shown to be cylindrical and thus allow up and down orientation adjustment of lens 48 by rotation of camera 14 according to arrow A3 in figure 2. In an alternate embodiment, not shown, joint 46 could also be a universal ball-joint, allowing for rotation along all three perpendicular axes of camera 14, so that lens 48 may be selectively oriented in a great variety of directions.

Figures 1 and 2 suggest that supporting arm 40 is hollow, and houses a wire 50 connected to camera 14, running in arm 40 and protruding beyond the arm (tip) first end 40a and down behind the back of the speaker S. Wire 50 is plugged to transmitter 16 at its other (bottom) end, and thus links camera 14 thereto. Transmitter 16 includes an intrinsic and autonomous power means, preferably in the form of a portable 12 Volt battery, for powering transmitter 16, camera 14 and microphone 47. Wire 50 can be used as the antenna for transmitter 16. Preferably, a LED or another similar device is provided on transmitter 16 to indicate the level of power remaining in the battery, with the LED emitting a different colour as the battery is being gradually used up, for example green when the battery is new, switching towards a yellowish colour as the battery becomes moderately used up, and changing to a red

light as the battery's life span comes to an end.

Preferably, joint 46 further carries a small microphone 47 therein, with a number of small holes 49 being provided through casing 46 for allowing the sound to reach microphone 47. This allows apparatus 10 to catch sound waves from the speaker's mouth, and transmit them to remote amplifiers, preferably the portable hearing impaired persons' amplifiers.

In use, a speaker S, such as a teacher for hearing impaired children H as shown in figure 1, wears headset frame 12 on her head, and adjusts the position of camera 14 relative to her mouth, by means of the rotation of dial 28, of linear displacement of arm 40 inside dial 28, and of rotation of camera 14 on joint 46. The purpose of adjusting camera 14 is for its lens 48 to precisely target the mouth of speaker S and to be located exactly ahead of the speaker's mouth, so that the images caught by camera 14 are the images of at least the mouth and preferably also all the facial expressions of the speaker S. Other adjustment means can also be envisioned for the camera 14, such as an articulated arm or any other suitable device. However, it is understood that once the positional adjustment of camera 14 is accomplished, the latter becomes rigidly supported by the headset frame 12: that is to say, the camera will then be held in a motionless fashion relative to the headset frame during use.

These images and the sound waves from the microphone are transmitted through wire 50 into transmitter 16, which codes the images into a proper signal, preferably being either one of radio waves, micro waves and infra-red waves, with the radio wave transmission being preferred over the other types of transmission. This wireless signal is transmitted by transmitter 16, as an airborne signal and received by a number of remote receivers 18 located on the desks

of the hearing impaired persons H. The receivers 18 decode the signal sent by transmitter 16 into images that can be visualised by proper visualising devices 20, e.g. video monitor screens, computer screens, LED or LCD screens; and into sound that can be heard or partly heard with proper amplifier devices, such as the hearing impaired person's hearing aids 52 or speakers 54 that are schematically shown in figure 1. In the case of hearing aids 52, it is understood that conventional hearing aids which include an audio signal receiver, could be used.

Thus, the hearing impaired persons H can read the lips of the speaker S at all times, even if she has her back turned to persons H, e.g. to write on a blackboard against the wall as suggested in figure 1, due to the image of the speaker's mouth being reproduced on the visualising screens 20 provided for the hearing impaired persons. Also, the hearing impaired persons who are not completely deaf, will be able to partly hear the voice of the speaker simultaneously, either directly and/or through the audio signal carrying the sound waves caught by microphone 47. It is noted that most hearing impaired persons will in fact be able to at least partly hear certain sounds. For example, it is not an uncommon occurrence that hearing impaired persons are able to hear low frequency sounds, while not being able to hear higher frequency sounds; this hearing pathology can be seen especially with hearing-impaired children. Also, it is possible that hearing impaired persons are able to hear higher frequency sounds, while not being able to hear low frequency sounds; these last hearing problems often result from industrial-related machinery which works at low frequency. Generally, it is noted that the human hear can be sensitive to frequencies ranging from 20 Hz to 20000 Hz, and partial deafness often occurs only as applied to a portion of this frequency range for a particular

individual. Thus, often with the help of amplifying hearing aid devices, the hearing impaired persons will listen to the speaker's voice and will be able to hear part of this speech, will accomplish lip reading directly on the speaker's face when the latter can be readily observed, and will use the visualising screens 20 when not able to either hear properly or to see the speaker's face and mouth to accomplish lip reading by direct eyesight.

Linking camera 14 to transmitter 16 by a wire 50 prevents transmitter 16 from having to be located on headset frame 12 proper, which would render same uncomfortably heavier. With wire 50, transmitter 16 can thus be located on a remote location on the speaker S, for example attached to her belt as shown in figure 1. It could also be inserted into a shirt pocket or the like. The purpose of this is to prevent this more heavy and cumbersome equipment from being supported by the speaker's head. Notwithstanding the load supported by the speaker's head, it would however be at least as convenient that the transmitter be located on the headset frame head-engaging portion, including a small antenna thereon, especially if a lighter power means and transmitter assembly is available.

Figure 1 further shows that transmitter 16 comprises an enclosed battery section 16a, which may be distinct therefrom, wherein a power supply battery may be inserted.

A best mode embodiment of the apparatus according to the invention would enclose all speaker components inside a head set assembly.

A more simple while still acceptable embodiment of apparatus would include the following components:

1) Student:

a) Video monitor - color Portavision 5 inches model, Radio Shack; or preferably, a LCD video screen, e.g. from Sony;

b) FM receiver - model 900AMBBR, Microtech Electronics (San Clemente, CA);

2) Teacher:

5 a) transmitter - FM wavelength emitter, model Minilink 001823, Microtech Electronics, with on/off switch;

b) 2 x 6 volts batteries, 1.2 Amp. "Exaltor";

c) micro colour solid state board camera with 4.4mm diameter lens, and with digital processing, model UN411E ultra micro remote colour CCD camera from "Elmo".

10 Obviously, the invention is not limited to such a given embodiment. The camera, in particular, may be one of many known miniature cameras sold on the market. The known technologies include optical fibre-based cameras, medical-type cameras (usually enclosed in a protective casing), or the above-mentioned solid state board camera. Other suitable image capturing devices such as CMOS imaging devices are also deemed to be included in the expression "camera". Also, it is envisioned that the transmitter be included with
15 the camera and the microphone in a single casing.

Throughout this specification, reference has been made to hearing impaired persons; it must be understood that partly or completely deaf persons are included in the expression "hearing impaired persons".

20 It is an important feature of the present invention that transmission of the video and audio signals occur in real-time. As stated in the Background of the Invention section, real

time is defined, according to a person skilled in the art of the present invention, as a maximum delay of 33 msec between the moment when the image is perceived and the moment when the sound is perceived by the hearing impaired person. Considering that the speaker will be emitting sound when speaking and that it is possible, or even likely, that the hearing-impaired persons will partly hear the speaker's voice directly (i.e. not through apparatus 10), then the transmission of the images and of the sounds captured through apparatus 10 must occur so that no more than a 33 msec delay occurs between the image and sound capture, and the image and sound perception by the hearing-impaired person through apparatus 10. This way, the images seen of the visualising screens 20, the sounds heard through the amplifying hearing aids and the sounds heard directly from the speaker's mouth, will coincide, and any lip reading accomplished on the screens 20 will register with the voice of the speaker.

The audio signal is not problematic, since very little information is transferred therein relative to the video signal. Thus, it is easy to transmit the audio signal through apparatus 10 to the amplifying hearing aids within the 33 msec delay.

The video signal, however, is another matter, since image signals carry much more information. It is known that to capture an image and transmit it directly to a video screen, a delay of approximately 33 msec is required (i.e. 16,5 msec per half image). Thus, for the image transmission to remain within the required limit of 33 msec, the image must be transferred directly to the visualising screens 20, without any software acting on the video signal for correcting the image, because software image correction is time-consuming, i.e. at least about 500 msec for a full image. Furthermore, signal compression through a MPEG

compressor takes approximately 33msec, as does the decompression through a MPEG decompressor, and thus compression and decompression of the image signal cannot occur.

Therefore, image treatment is not an option, nor is compression of the image information, or else the image seen on the visualising device by the hearing-impaired person will be sufficiently offset relative to the voice partly heard from the speaker directly through class or through a hearing aid, for the hearing-impaired person to notice this offset. Reconciling the image seen on the screen and the speaker's voice can then become very difficult, and consequently trying to understand the speech becomes confusing and a difficult, if not impossible, task.

Thus, in the present specification, when it is stated that real-time transmission of the images occurs, it is understood that the images of the speaker's mouth and face are displayed on the visualising screens 20 within a 33 msec delay. With the actual technology, this means that no image treatment will occur, such as image correction software to correct the distortion of the images caught by the camera, or compression or decompression of the image through devices such as MPEG compressors and decompressors.

According to a preferred embodiment of the invention, transmitter 16 includes a video transmitter and an audio transmitter, each distinct from the other. Thus, the audio signal and the video signal are distinctly transmitted to the receivers 18. Preferably, the video signal is transmitted on a radio wave band located in the 902-928 MHz range and the audio signal is transmitted on a radio wave band located in the 72-76 MHz range, the latter being the usual band used for hearing aid devices – and thus the system of the present invention may be compatible with conventional hearing aid devices. This low frequency for the audio signal also

has the advantage of providing a more stable carrier wave, which may travel further for a same power output and which will suffer less loss of its signal. Alternately, the video signal can also be transmitted at a frequency range of 2400.0 to 2483.5 MHz, and the audio signal can also be transmitted at a frequency range of 216 to 217 MHz.

5 The fact that the audio and video signals are transmitted on two different bands, helps prevent the sound signal from being interrupted or polluted by video signal irregularities. Indeed, it is important to note that the video image of the speaker's mouth on the visualising screen is only a fall-back option for the hearing impaired person, who will normally read the speaker's lips directly and who will possibly partly hear the speaker's voice. The image on the
10 screen will only be used when the speaker's lips cannot be read directly, so the sound signal often becomes more important than the image itself for the hearing-impaired persons that are equipped with a hearing aid device linked to apparatus 10. Thus, it is important that the sound signal be as clear as possible, and consequently the video image is transmitted on a different band than that of the sound signal.

15 It is further envisioned to use two or more redundant channels for the audio signal, from which the hearing-impaired person can choose according to the best reception.

It is noted that the transmitter and receiver of the present invention are substantially closely positioned relative to each other. Indeed, contrarily to video-conferencing devices such as the one disclosed in the above-mentioned prior art Bullister patent, the
20 apparatus 10 according to the present invention is destined to be used in a single general area, for example a single student class. The speaker is located in front of the class with his or her

transmitter, while the hearing impaired persons are seated in class at a distance with their receivers and visualising devices, with the wireless broadcast communication occurring between transmitter and receiver. This allows the system according to the present invention to use low-power transmitters, which have two very important advantages which bring about surprising and unexpected results:

1) They do not require compulsory government regulatory licenses for communication devices that are otherwise required for transmitters transmitting at higher power, these licenses being granted by a communication regulatory body in most countries, such as Canada and the United States.

2) They prevent different devices according to the invention and used in a same building, e.g. in a school, from hampering one another's signals, due to the different signals which could overlap one another if more powerful transmitters were used.

The expression "low-power transmitter" includes transmitters emitting at a power which allows the air-borne wireless signal to be received in a close vicinity relative to the transmitter, e.g. in a same room or in an adjacent room, while not covering important distances.

The preferred maximum field strength of the emissions originating from the transmitter of the present invention is as follows, to obviate the obligation to obtain a regulatory license according to North-American standards: 50 millivolts per meter for the video signal, and 80 millivolts per meter for the audio signal, with the measurements being taken at a distance of three meters from the transmitter. This transmitter power is enough for the purpose of transmitting the signals over short distances, e.g. in a same room or perhaps in an adjacent room at the most if little

interference from the wall structure between the rooms exists, but no more than that.

Wired communication over longer distances is likely to be accomplished through a modem or the like transmitter element, with relatively much longer delays of transmission of the image, which would result in the image not being displayed in real-time.

5 This is an important difference relative to known videoconferencing devices, which use wired communication since wireless broadcast communication would require licenses due to the large distances involved. Even in the invention disclosed in the above-mentioned Ono patent application, telephone technology is used for transmitting the data, even if radio-wave data transmission has been known and widely used for many decades.

10 To prevent video signal irregularities, the video transmission should be of the Double Side Band Amplitude Modulation (DSB-AM) type which substantially allows the carrier wave to be replicated or mirrored, with only the better wave received being kept for the display of the image. Alternately, the video signal can also be a numeric signal, a FM radio wave transmission, or any other suitable transmission mode.

15 Furthermore, a pre-emphasis is applied to the audio and video signals at the transmitter, and a de-emphasis is applied to the signals at the receiver, to help prevent undesirable noise on the signals.

An automatic gain control (AGC) circuit is preferably used to regularise the signal which is received by the receiver 18, as known in the art.

20 All the above-mentioned signal regulators which aim to provide the best output signal as possible for the best sound and image reproduction for the hearing-impaired person,

are rather important, especially considering that the wireless transmitter is mobile, and that the speaker can and often will move as he or she speaks. This is likely to result in interference over the broadcast airborne signals, especially considering that the system 10 according to the invention is likely to be used in a closed room, the surrounding walls and building structure then promoting wave reflection and consequently interference on the signal. Thus, the numerous methods used to correct this situation and provide a signal as clear as possible, especially for the sound signal, are very advantageous.

Moreover, it is envisioned to combine to the hearing impaired person's receiver a computer with a voice recognition software, that could put the speaker's speech in writing for ulterior revision purposes. This would be advantageous in the case of hearing impaired students, who would not have to take notes themselves during class, and who could consequently concentrate on understanding the speech of the teacher through lip-reading, instead of having to take down notes. For the voice recognition software to work properly, the audio signal must be as clear as possible. It is also possible to have a speech recognition software which would use both the audio and video signal to provide a text output, with both signals then being cross-analysed by the software; both signals then need to be as clear as possible.

Any minor modifications brought to the present invention as described herein which do not extend beyond its scope, are considered to be included therein.

For example, although each student H in figure 1 is shown to have one receiver 18 and one visualising screen 20 on his desk, it is understood that a single receiver 18 could be

provided for a number of visualising screens 20, e.g. if all the visualising screens 20 were network-linked computer screens. Also, a single receiver could be linked to a single visualising means in the form of a screen, preferably a giant-sized screen, facing all hearing impaired persons H. Also, although much more cumbersome, copper or optic fiber wiring could be used
5 to carry the signal from transmitter 16 to receiver 18 instead of airborne waves.

It is understood that the headset of the present invention could be modified to any other suitable desired configuration. Also, the camera support arm could be located on the right-hand side of the headset, rather than on the left-hand side as shown in the drawings.

Moreover, the apparatus described in the present disclosure can be of use for
10 persons without any hearing disabilities, particularly for children and teenagers located too far away from a teacher and who will use lip reading as complementary means for understanding the conversation; this method helps to direct the student's attention on understanding the meaning of what is said, rather than solely directing his attention on hearing what is said. Also, the use of the present apparatus can be extended to drive-through type restaurants, where it is
15 preferable to see the face of the restaurant employee speaking in addition to hearing his or her voice, when ordering food from a remote location outside the restaurant.

I CLAIM:

1. A real-time video-assisted apparatus for use by a speaker and hearing impaired persons, for reproducing in real-time an image of the speaker's mouth, comprising:

- 5 - a headset frame to be removably installed on the head of the speaker;
- a real-time image transmission and display circuit including:
 - a) a miniature camera rigidly carried by said headset frame ahead of the speaker's mouth and destined to target at least the speaker's mouth for catching continuous video images therefrom;
 - 10 b) a low-power video transmitter operatively linked to said camera, for coding the video images caught by said camera and for real-time transmission thereof as a low-power wireless video signal, said video transmitter including a power device for powering said camera and said video transmitter;
 - c) at least one video receiver, located substantially closely to said video transmitter, for receiving said low-power wireless video signal in real-time from said video transmitter and decoding it into video images; and
 - 15 d) at least one visualising device operatively linked to said at least one video receiver, for visualising the images decoded by said video receiver in real-time relative to the sound emitted by the speaker;

20 wherein said apparatus includes a real-time transmission of the images of the speaker's mouth to said at least one visualising device, whereby at least the lip movements of the speaker are

followed in real-time simultaneously by any number of hearing impaired persons looking at the visualising device notwithstanding the head orientation or position of the speaker relative to the hearing impaired persons.

5 2. A video-assisted apparatus as defined in claim 1, wherein said video transmitter emits said video signal at a maximum field strength of 50 millivolts per meter measured at a distance of three meters from said video transmitter.

10 3. A video assisted apparatus as defined in claim 1, further comprising:

- a microphone carried by said headset frame and linked to an audio transmitter, for catching the sound waves emitted by the speaker's voice in a continuous fashion;
- a low-power audio transmitter operatively linked to said microphone, for coding the sounds caught by said microphone and for real-time transmission thereof as a low-power wireless audio signal, said audio transmitter including a power device for powering said
15 microphone and said audio transmitter;
- at least one audio receiver, located substantially closely to said audio transmitter, for receiving said low-power wireless audio signal in real time from said audio transmitter and decoding it into sounds; and
- at least one amplifying device operatively linked to said at least one audio receiver,
20 for emitting the sounds decoded by said audio receiver in real-time relative to the sound emitted directly by the speaker;

wherein said apparatus includes a real-time transmission of the sounds of the speaker's mouth to said at least one amplifying device, whereby the speech of the speaker can be simultaneously heard directly from the speaker and through said video-assisted apparatus.

5 4. A video-assisted apparatus as defined in claim 3, wherein said audio transmitter emits said audio signal at a maximum field strength of 80 millivolts per meter measured at a distance of 3 meters from said audio transmitter.

10 5. A video-assisted apparatus as defined in claim 4, wherein said video transmitter emits said video signal at a maximum field strength of 50 millivolts per meter measured at a distance of three meters from said video transmitter.

15 6. A video-assisted apparatus as defined in claim 5, wherein said video transmitter and said audio transmitter are two separate units, and wherein said audio receiver and said video receiver are also two separate units, whereby said wireless video signal and said wireless audio signal are transmitted as two distinct signals on respective wave bands.

20 7. A video-assisted apparatus as defined in claim 6, wherein said video signal is transmitted in the frequency range of 902-928 MHz, while said audio signal is transmitted in the frequency range of 72-76 MHz.

8. A video-assisted apparatus as defined in claim 3, wherein said video transmitter and said audio transmitter are embedded into a single transmitter element, whereby said audio signal and said video signal are transmitted as a single, combined signal.

5 9. A video-assisted apparatus as defined in claim 3, wherein said amplifying device is a hearing aid device.

10 10. A video-assisted apparatus as defined in claim 3, wherein said microphone, said audio transmitter and said audio receiver are sensitive to a frequency range substantially within the average human sound sensitivity of 20Hz to 20 000 Hz.

ABSTRACT OF THE DISCLOSURE

The apparatus for hearing impaired persons of the present invention comprises a telephone receptionist style headset which is to be worn by a speaker person on her head, in the conventional way. This headset is equipped with a frontwardly extending support arm which carries at its front free end a miniature camera, and an optional microphone, targetting the speaker's mouth. The camera is linked by a wire to a transmitter having intrinsic power means, which transmits in real time the images caught by the camera as a wireless signal to receivers located remotely of the transmitter, e.g. on desks in a classroom. The receivers decode the signal and retransmit the images to television screens. Thus, hearing impaired persons can observe the screens to read the lips of the speaker person, so as to understand the conversation, notwithstanding the head orientation of the speaker person. The wireless transmission is of low power, to obviate the necessity of obtaining compulsory licenses otherwise required by government regulatory authorities for wireless transmission, and to prevent two or more wireless signals from different transmitters simultaneously used in different locations from interfering with each other.

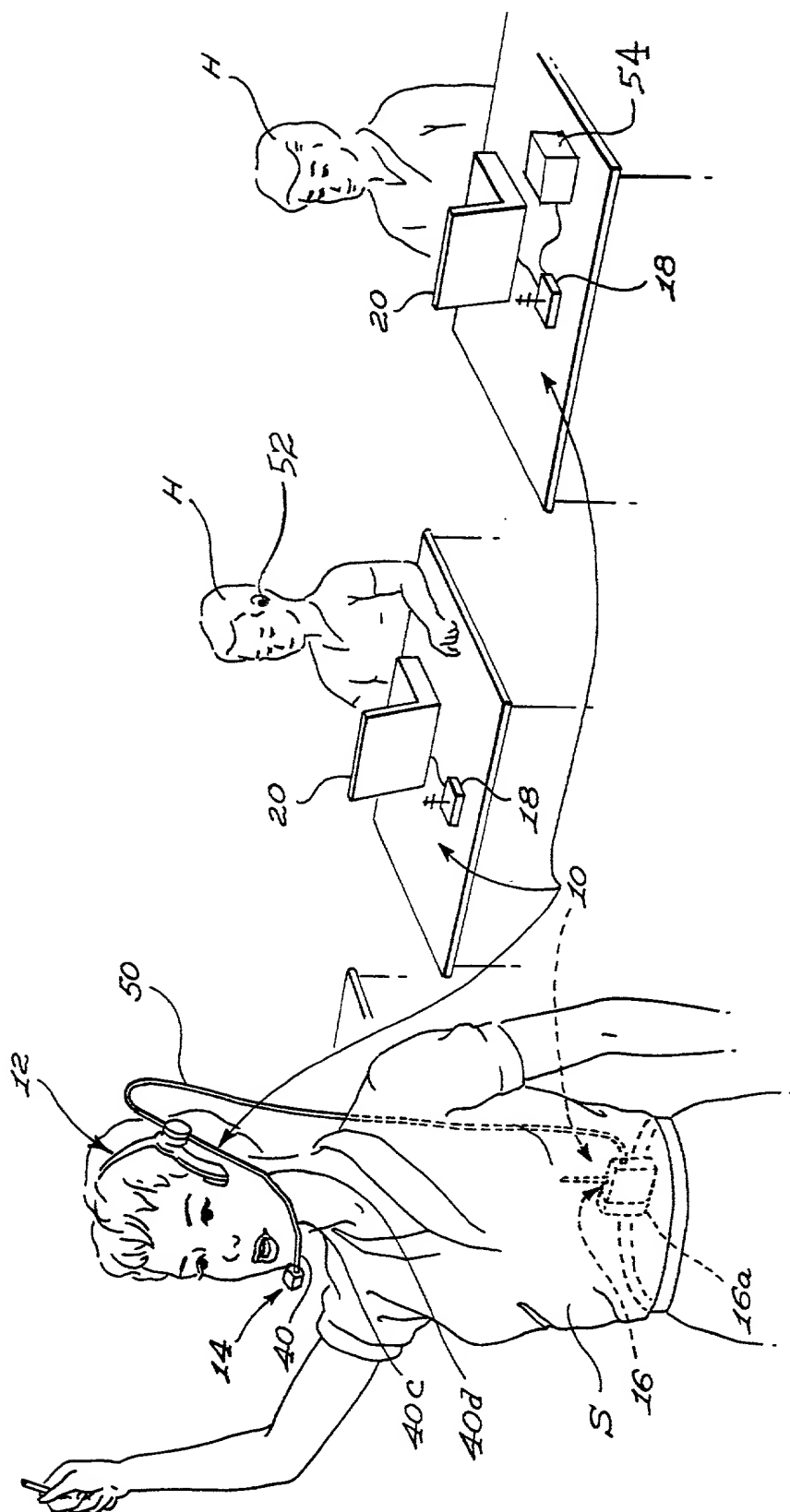
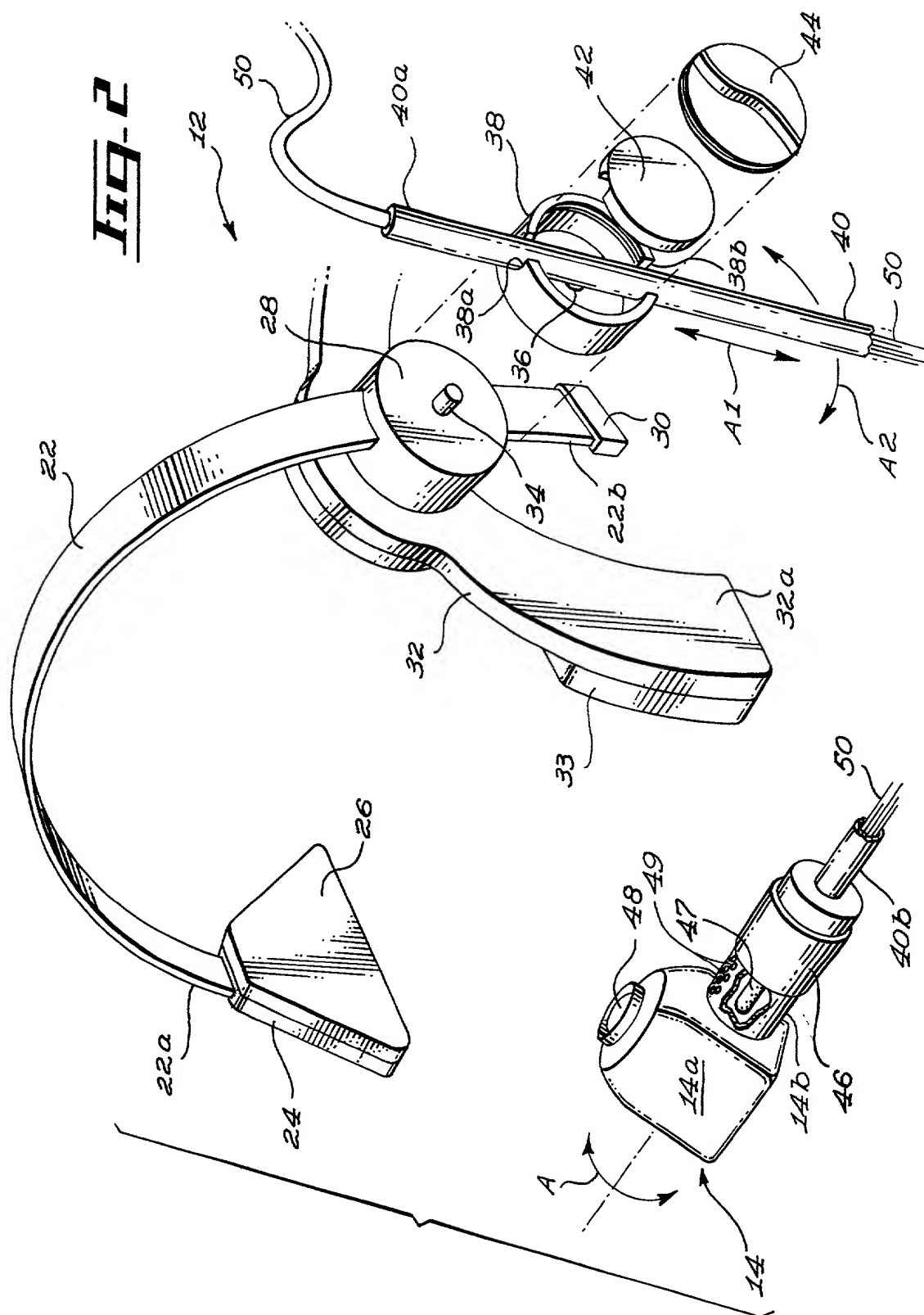
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Fig. 1



DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION
DECLARATION ET POUVOIR POUR DEMANDE DE BREVET

FRENCH LANGUAGE DECLARATION

Form PTO-FB-235 (8-83)

En tant qu'inventeur nommé ci-après, je déclare par les présentes que mon nom, mon domicile, mon adresse postale et ma nationalité sont ceux qui figurent ci-après. Je déclare que je crois être l'inventeur original, premier et unique (si un seul nom figure sur le présent acte) ou un des co-inventeurs, originaux et premiers (si plusieurs noms figurent sur le présent acte) du sujet revendiqué et pour lequel un brevet est demandé sur la base de l'invention intitulée:

dont la description:

_____ est annexée aux présentes
_____ a été déposée: No de série
de la demande et date de dépôt:

Je déclare par les présentes avoir examiné et compris le contenu de la description identifiée ci-dessus, revendications y compris, et le cas échéant telle que modifiée par un amendement. Je reconnais le devoir de divulguer toute information qui soit en rapport avec l'examen de cette demande selon le titre 37 de la Codification des Règlements Fédéraux § 1.56(a). Je revendique par les présentes le bénéfice de priorité étrangère selon le titre 35 de la codification des Etats-Unis, § 119, de toute demande de brevet ou tout certificat d'auteur énuméré ci-après, et j'ai identifié

As a below-named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name. I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

VIDEO-ASSISTED APPARATUS FOR
HEARING IMPAIRED PERSONS

the specification of which

XX is attached hereto;
_____ was filed : serial no and
filing date of application:

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a). I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's

également ci-après toute demande étrangère de brevet ou de certificat d'auteur ayant une date de dépôt antérieure à celle de la demande pour laquelle la priorité est revendiquée:

demande(s) antérieure(s) dans un autre pays:
pays/ dem. no. /date de dépôt

Je reconnais le devoir de divulguer l'information pertinente selon le titre 37 de la codification des règlements fédéraux, § 1.56(a), sur toute information qui se présente entre la date de dépôt de la demande antérieure et la date de dépôt de cette demande, soit nationale, soit internationale PCT. Je déclare par les présentes que toutes mes déclarations, à ma connaissance, sont vraies et que toutes les déclarations faites à partir de renseignements ou de suppositions, sont tenues pour être vraies; de plus, toutes ces déclarations ont été faites en sachant que de fausses déclarations volontaires ou autres actes de même nature sont sanctionnés par une amende ou un emprisonnement, ou les deux, selon l'article 1001, du titre 18 de la Codification des Etats-Unis, et que des déclarations délibérément fausses peuvent compromettre la validité de la demande ou du brevet délivré.

certificate having a filing date before that of the application on which priority is claimed:

prior foreign application(s):
country/serial no./filing date

I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56 (a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

This application is a continuation in part of the United States application No. 08/867,024 filed June 2, 1997.

POUVOIR

En tant qu'inventeur, je désigne les agents de brevets suivants pour poursuivre la procédure de cette demande et traiter toute affaire la concernant par devant le bureau des brevets et marques:

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Je nomme également comme représentant pour signification aux fins de recevoir tout avis affectant le brevet ou les droits en découlant:

Nom complet du seul ou premier inventeur:

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date: _____ 20__

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